Vol. 10 SEPTEMBER, 1945 No. 9

CORNELL-DUBILIER ELECTRIC CORP.
HAMILTON BOULEVARD
SOUTH PLAINFIELD, N. J.

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Mr. Philip Kipp
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TONE CONTROL CIRCUITS*

Tone controls, like the weather, will always be with us, the reason being the lack of uniformity of the ears of listeners and the highly varied tastes of different individuals, not to mention special applications such as sound effects, static and hum reduction, and compensation to make up for a deficiency in frequency response in some unit. We have a multitude of types to pick from, all the way from a simple high frequency attenuator which consists of a series resistor and condenser shunted from a grid or a plate of an amplifier tube to ground, to a complex multisection band pass filter. For the reduction of noise, etc., a simple high frequency attenuator is adequate, but where response is to be altered to fit personal tastes, more than attenuation is desirable.

A good compromise is two controls which may attenuate or boost either the high or low frequencies. The frequencies at which these controls start to be effective are a matter of taste and the quality of the audio system to which they are applied; i.e., there would be no point in boosting 20 c.p.s. in a system whose speaker could not reproduce frequencies lower than 50 c.p.s., nor would anything be gained in boosting 9000 c.p.s. response in a receiver whose i.f. system was so sharp as to limit the detector output to 4000 c.p.s. The points of boost and the amount then must be determined first. What is desirable there, and why must there be boost at all?

First we have the problem of the peculiar condition of the ear wherein the response curve changes with level. That is to say, if sounds are loud enough, your ear has a flat response to them from say 30 c.p.s. to 10,000 c.p.s. If the level is lowered appreciably, the ear response falls off faster at 30 c.p.s. and 10,000 c.p.s. than it does at 3,000 c.p.s. Now if we were present in the studio when a recording was made, we would hear the orchestra at its normal volume. If we were to play the recording of the same orchestra back at the same volume that we heard it, we would require a completely flat system from the recording microphone to the phonograph speaker. But unfortunately, we do not play back orchestral renditions at their original volume, particularly if we live in apartments. We therefore must replace the decreased sensitivity at high and low frequencies of our

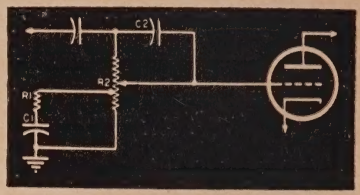


Fig. 1. Automatic tone control incorporated in volume control circuit.

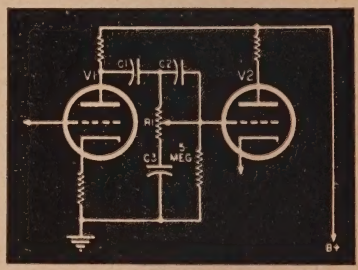


Fig. 2. Circuit combining both low- and high-frequency attenuation, depending on the position of the single control.

* *By J. Carlisle Hoadley in "Radio News."*

ear at this new low level. As people's ear-curves vary, the amount of compensation necessary is not a constant. Neither do all bands play at the same volume, so some variable means must be provided to give the individual listener that feeling of naturalness which is necessary for his complete enjoyment of recorded or broadcast music.

There is a second reason, too, for compensation. A great reduction in extraneous noise may be effected by the limiting of the range to that necessary for the program material. For instance, if one is listening to a trumpet solo, there is no benefit in having response down to 30 c.p.s., and if it is limited above 60 c.p.s. or 120 c.p.s., there will be a material reduction in hum. Conversely, if a phonograph record which is old and possesses a high scratch level is played, a flat response to 10,000 c.p.s. is undesirable. In connection with high frequency response, an interesting point is that if the response is limited to say 5,000 c.p.s. with a boost between 3,000 and 5,000 c.p.s. and then cut off sharply, the effect to the ear is very nearly that of flat response out to a much higher frequency, with, incidentally, a material reduction in surface noise of records, static, etc. Let us therefore discuss some methods for obtaining high and low frequency compensation in some specific circuits.

In Fig. 3 we see several high and low frequency tone control circuits. C_1 and R_1 comprise a low frequency attenuation circuit. The variable resistance R_1 places in the circuit or removes series condenser C_1. As C_1 is low in capacitance the low frequencies are attenuated. The values in the diagram are correct for attenuation below 150 c.p.s. Between V_1 and V_2 we have a negative feedback type bass boost circuit, consisting of R_2, C_2, and R_3. The output of V_2 is fed back through the RC combination to its grid and the amount of boost possible is determined by the mu of V_2. As a method of control of the amount of boost without varying the gain of V_2, we short out the condenser C_2. This eliminates the high-pass nature of the network and it feeds back all frequencies equally. When R_3 is set at its maximum value, only the higher frequencies are fed back, determined, of course, by the value of C_2, and the gain is only reduced at the higher frequencies effecting a bass boost.

In the cathode of V_2 we have a high boost circuit comprising R_4, R_5, and C_3. The cathode resistor is made larger than usual and may even be larger than the plate resistor. We then bypass the cathode resistor with a condenser whose bypass effect is variable by the series variable re-

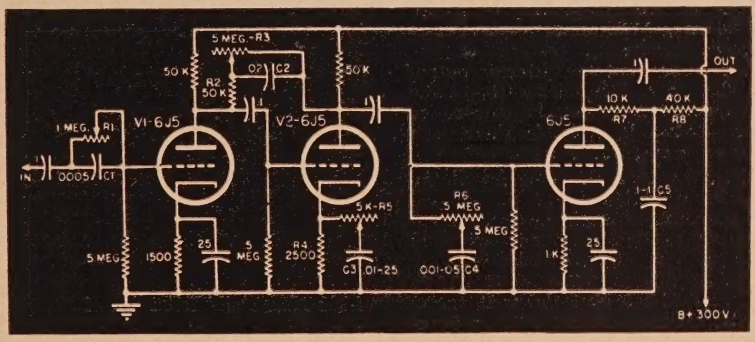


Fig. 3. Several methods of obtaining high- and low-frequency tonal compensation.

sistor R_5. The gain of V_2 is reduced by the degeneration introduced by the unbypassed cathode resistor. The value of C_3 determines at what frequency the degeneration will be relieved, and the tube operate at its full gain. Then we have a high boost whose starting frequency is determined by the value of C_3. It is dependent, too, on the size of R_4. The value can be arrived at by experimental insertion methods to fit a specific case much more readily than as if it were computed because of the assumption one must make in regards to the exact frequency we wish to boost to make a noisy record sound better for instance. Incidentally, one would not use the two circuits R_2, C_2, R_3, and R_4, R_5, C_3 in the same tube, as drawn, as they are negative feedback controls and would defeat each other's purpose. These degeneration circuits are good in the respect that they actually reduce the distortion at the attenuated frequencies, and do not increase it at the boosted frequencies. Their disadvantage is that they consume gain and it may be necessary to add an extra stage of amplification to offset the loss. In R_6 and C_4 we have the time worn high

the plate circuit of the last 6J5 we have another bass boost circuit. It consists of R_7, R_8, and C_5. R_7 and R_8 are the plate load resistors of V_3. R_8 is partly bypassed by C_5 so that at low frequencies the gain of V_3 is that obtained with a load resistor equal to R_7 plus R_8, while at high frequencies the gain is that obtained with only the plate load resistor R_7. The ratio of their sizes determines the amount of boost, and C_5 determines the frequency at which it occurs. It must be borne in mind that Fig. 3 was drawn with the idea of presenting these different methods of tone compensation and does not represent a three tube amplifier as such, but merely serves as an illustration. These are the simpler types of tone controls which may be used where very sharp cutoff characteristics are not desired. If steeper transition slopes from boost to flat are desired, the same circuit may be used in successive stages, giving steeper transitions and greater boosts. Controls may easily be ganged such as duplicating the R_4, R_5, C_3 network in a later stage and then using a two gang variable control (R_5) so that the degeneration in both stages may be varied simultaneously.

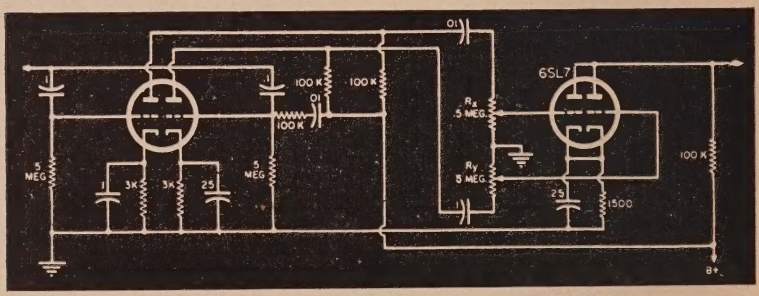


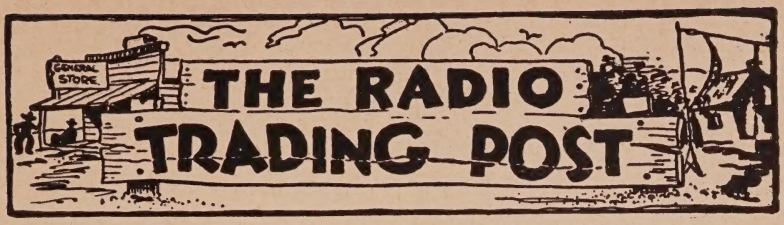
Fig. 4. Circuit employing separate amplifier stages for the high- and low-frequencies. By varying the gain of these stages, desired tonal response may be had.

frequency attenuating "tone" control which was standard equipment on nearly every radio in the past. It still has its uses, however, when the high frequencies are to be attenuated without too steep a cut off. In

So much for the general RC circuits which may be used, let us now consider some specific applications.

In Fig. 2 we have a simple tone control circuit which allows the lows

(Continued on page 11)



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FOR SALE—Majestic radios and all makes of spkrs. Kolster, Fada, Colonial, Philco and Atwater Kent Radios. RCA-Victor R32 chassis. Louis A. Goldstone, 1279 Sheridan Ave., Bronx 56, New York.

SALE OR SWAP—Dependable tube tester model 305, demonstrator, A1 condition, by Radio City Products Co. Best cash offer or exchange for Remington automatic 3 or 5 shot 12 ga., or Browning in A1 condition. Furch Electric Co., Comfrey, Minn.

FOR SALE—Rider's 3, 4 and 5, $7.35 each. Electric "Radio Service" sign, flashes R-A-D-I-O, $15. R. Thomas & Son, 208 Cleveland St., Nashville 7, Tenn.

FOR SALE—Hard to get tubes, such as 12SA7, 12A6, 6A7, 6SA7, 3524, etc. At ceiling price. Send for list, also parts. Victor Kozma, 3104 Wilkinson Ave., New York 61, N. Y.

WANTED—25B8 and 6Z5 tube, also condenser checker. We are available as agents for any type household appliance or elec. appliance on consignment basis. Croydon Electrical Appliances, 413 Willis Ave., New York 54, N. Y.

WANT—World War II vet. needs Rider's Manuals, will pay cash, also test equipment in good working condition, all offers answered. Sam Torrisi, 57 Mechanic St., Lawrence, Mass.

SALE OR TRADE—Radio transmitter 500 watts, long and short wave, also a short wave radio goes with it. Tony Zucco, 3rd St., Cresson, Pa.

FOR SALE—Two tube short wave receiver covering 15,000 to 1500 kc with built-in code practice oscillator. In metal cabinet. Works good. Extra set tubes and key included, $25. George Maxey, 536 Talbot Ave., Albany 6, California.

FOR SALE—Radiotone model 16 professional recorder. Dual speed, 16 in. turntable, outside-in and inside out, overhead lathe type feedscrew, variable lines per inch, with playback, like new, sell at cost. Bill Gall, RFD 1, Harrisburg, Illinois.

FOR SALE — Headphones without headstrap. Has PL-54 plug attached. In good condition, 2000 ohm. John Poirier, Harlowton, Montana.

FOR SALE—Bargains. 10 spindle Boley tapping mch. adjustable spindle positions. 10 spindle P. & W. drill press, adjustable spindle positions. Centre Machinery Co., 249 Centre St., New York 13, N. Y.

SWAP—0-10 ammeter will swap for 2 50L6 tubes. J. M. Slocik, Box 66, Springdale, Pennsylvania.

WANTED—Riders Manuals 6 to 13, also radio tubes, send list. Want Superior signal gen. No. 1230. Charles I. Amplo, 2228 Newbold Ave., Bronx 61, New York.

WANTED—Watchmaking books or course, electric train set, Precision signal generator, Riders 10-13, text books. Have camera, rifle, telescope, light meter, G-E phono motor, new bike brake. W. J. Closson, 295 — 8th St., Troy, N. Y.

GERMAN TUBES NEEDED—Phillips UCH-21, Osram EU-XX 35-70V0, 2Ab36, also need tube characteristic sheets and tube tester for European types and service notes on same. What have you and if cash or trade. Richard G. Devaney, 216 South 60th St., Philadelphia 39, Pa.

FOR SALE—Triplett mod. 677 dc vltmtr., 1000 v., No. 675 dc milliammeter; No. 673 ac vlmeter 0-1000 v., No. 678 ohmmeter, 0-10 meg.; leather case $15 each. Triplett 1200-E, $30; sig. gen. mod. SG, $40; Philco record player, $50. Elizabeth H. Beebe, Vivian St., Rfd. 2, New London, Conn.

FOR SALE—German aircraft transmitter-receiver (42-48 mc) unit. Dynomotor unit separate. Equipment never been in operation. Diagram and data, in German, of earlier model included. Best offer takes. Pfc. H. Schutzman, 1662 Hoe Av., Bronx 60, New York.

SALE OR EXCHANGE—Brunswick hi-boy radio; Radio City tube checker; 3 table radios; small recording machine and play-back; short wave amplifier, connect to any radio. Joe Freed, 2427 Webster Ave., New York City.

FOR SALE—Triplett mod. 1501 tube tester and analyzer; tube tester to 30v, multitester 1000 ac or dc; 1 to 10 meg., condenser tester. A1 condition. Charles H. Royer, 391 Liberty St., Allentown, Pa.

FOR SALE—About 100 assorted radio tubes at 30% below ceiling price. Also small quantity assorted ballasts and panel lamps. Send for list. S. S. Schlissel, 3957 Gouverneur Ave., Bronx 63, New York.

FOR SALE—Compton's pictured encyclopedia, de luxe 1935 ed., 15 vols., in almost new condition, Cost $30, will sell for $35. Yoshinori Nakano, 33-N, Box 300, Fort Lincoln, Bismarck, N. D.

WANTED—A partnership, working or otherwise, in active radio and appliance repair shop. Metropolitan Providence area preferred but will consider other offer in East. Write Charles H. Coté, 111 Woodlawn Circle, East Hartford 8, Conn.

WANTED—Signal generator, also oscillator, all wave. State price and condition. Frank Cresswell, 48 College Ave., Tarrytown, N. Y.

FOR SALE—Gernsback Manuals 1-5, vol. 6 loose leaf, $12 the lot. Want Riders Manuals 9, 11, 12, any one of them in good condition. Frank Cresswell, 48 College Ave., Tarrytown, N. Y.

WANTED—Mimeograph machine. Will pay cash. Describe and state price. Stanley Galaski, 223—54th Street, Brooklyn 20, N. Y.

WANT—Riders Manuals 8 to 14. Will pay good price for same in good condition. State price. Samuel A. Hamel, 127 Lafayette Sq., Haverhill, Mass.

POSITION WANTED—Man, 35, desires to learn radio servicing and repair; good radio theory background; salary secondary. H. Schrapp, 1208—55 St., Brooklyn 19, N. Y.

FOR SALE—Nat. TML-200-DA 7500 v. tank cond, new, $25; 4 Nat. FXTB fixed tuned exciter tanks, new condition, $3.90 each; Bliley crystal, $3.80; Bliley HF-2 crystal, 14652 kc, $4.75. Both good shape. Donald Johnston, Rt. 2, Box 478-B, Kelso, Wash.

SELL — New wind power plant, 3½ kw generator, 80 ft. tower, 60 615AH lead cells; three used small dc-ac converters, 4 1-8hp motors, 85 assorted Edison cells, one 24/1500 v. dynamotor, 3 RCA 852 tubes. Grote Reber, 212 W. Seminary Ave., Wheaton, Illinois.

SWAP—Have Apex vac. sweeper, Stanley comb. plane, GE kw hr. meter, Superior 1130S set and tube tester, mod. 80 Motorola car radio, prof. electric hair clippers. Want test equipment, books, etc. Many interests. Glenn Watt, Chanute, Kans.

FOR SALE—New radio tubes, 1 or more each series, 1C5, 1LB4, 3A8, 6F5, 6J7, write for list of many others. List price less 15%. Elmer A. Glandorf, Williamsburg, Iowa.

FOR SALE OR TRADE—12" Wright Decoster speaker, $4.00; 12" Cinaudagraph PM in original carton, never used, $8.00. J. M. Kilroy, 9 Christopher St., Dorchester 22, Mass.

FOR SALE—2 home made amplifiers. Tube complements, 2-6V6, 1-6SC7, 1-6SK7, 1-80. 1-6L6, 2-6SK7, 1-80. Speakers not furnished. $25 each. Robert D. Freed, 1140 Fifth Ave., New York, 28, N. Y.

TRADE OR SELL—Electric 8" fan, 2 amp. tungar charger, 1 amp. copper oxide charger. Several voltmeters, write for particulars, movie projection course. I need photography equipment. Stanley J. Zuchora, 2748 Meade St., Detroit 12, Mich.

FOR SALE—About 100 QST's 1922 (4 issues) 1926 to 31 complete, bound 6 to a vol. Rest misc. issues. $9.00 f.o.b. T. A. Znotin, 54 Westmoreland St., Dorchester 22, Mass.

FOR SALE—60 watt Thordardson booster amplifier, RCA and Audak pickup, misc. meters. Send for list other parts. Ed. Monahan, Shawomet, R. I.

(Continued on page 13)

POWER TRANSFORMER SERVICING*

(Continued)

Increasing B Voltage

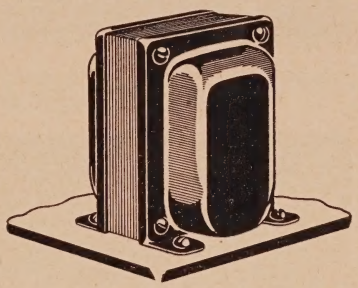
B-voltage adjustments can also be made by changes in the filter circuit. For instance, the voltage drop in a dynamic speaker field or additional filter choke may be used to adjust the B voltage. Fig. 3a shows the field used as a choke. When it is desired to increase the B voltage, the IR drop in the field may be eliminated by the use of a p-m speaker, as in Fig. 3b. The power-output tubes then receive their supply directly from the rectifier. Additional filter capacitance will probably be required.

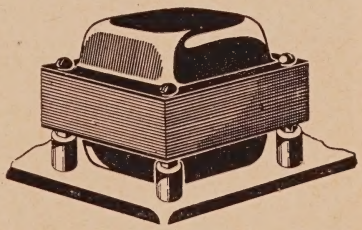
Replacing Open High-Voltage Transformer

When a high-voltage winding opens in a transformer and there are no shorts, the line voltage may be used for B supply. Fig. 4a shows a typical half-wave supply for small sets which may be replaced by the arrangement in Fig. 4b, which uses the same transformer or simply a filament transformer. There will be a reduction in power output but the sensitivity will usually not be lowered materially. Since the chassis will become alive with line voltage, certain precautions are imperative. An insulated panel for chassis grip should be inserted so that contact with the chassis is impossible. It is also necessary to avoid set screws on knobs or live dials, etc. The line plug should also be marked for polarity, when possible, so that the chassis is at ground potential.

Mounting Transformers

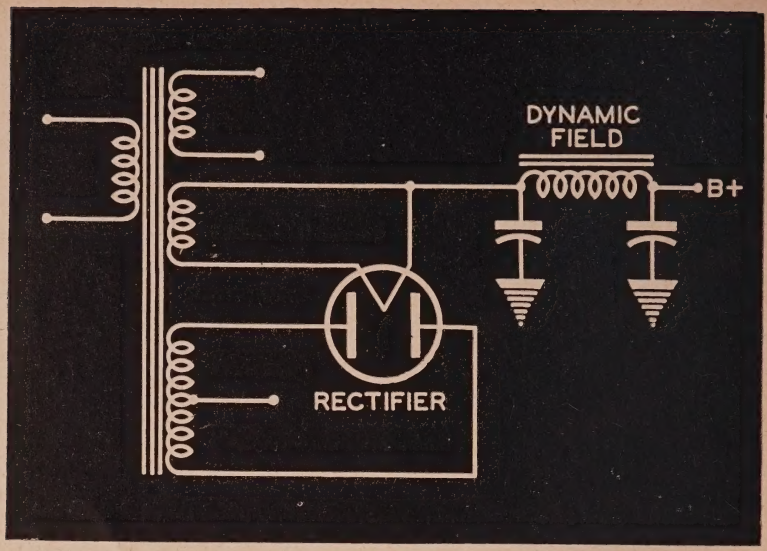
When horizontal-core replacement transformers are used in place of upright types they should be mounted as shown in Fig. 5. This eliminates the tedious job of cutting a large hole in the chassis. Transformers that emit an annoying buzz may usually be cured by wedging a wooden shim between the coil and lamination. If this doesn't work, restacking the laminations may be necessary. The preferred method of stacking is to alternate the laminations, one in one direction, the next in the opposite direction, not in groups of four or five as they are sometimes assembled.



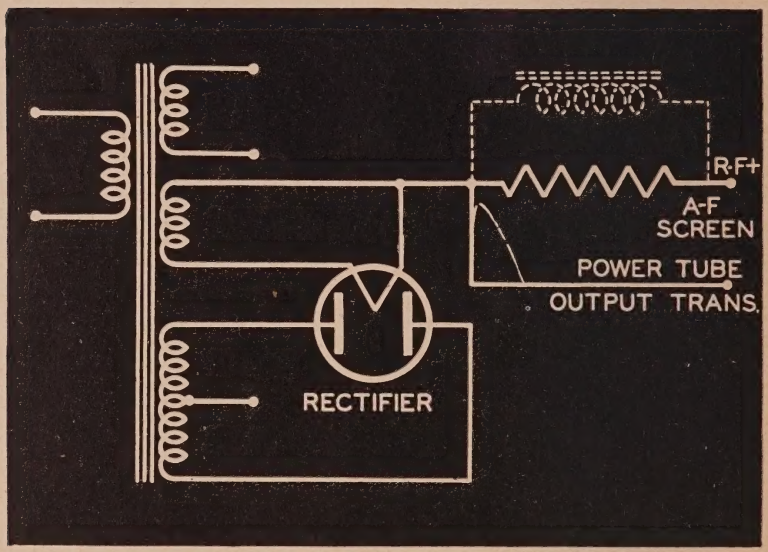


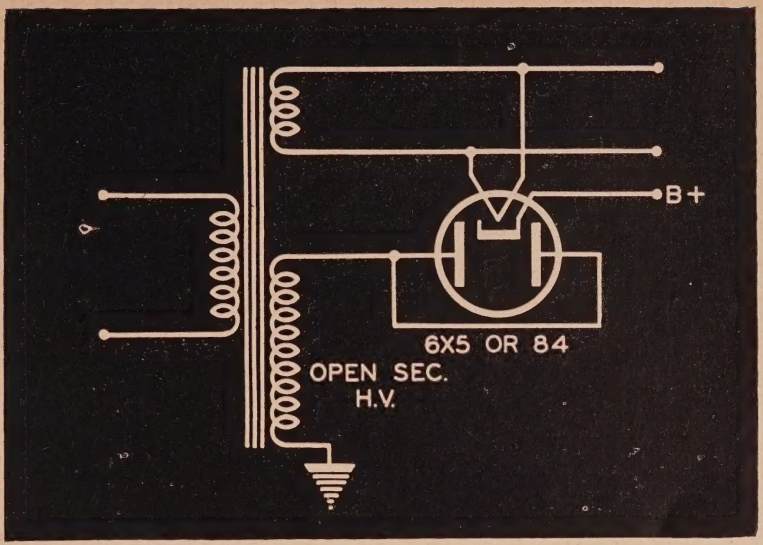
Figs. 5a (above) and 5b (below). In replacing an upright transformer with a flat-mounted type, the method shown in b should be used. The chassis should not be cut. Instead mount as indicated, using spacers.

* *By Arnold D. Peters in "Service" magazine.*

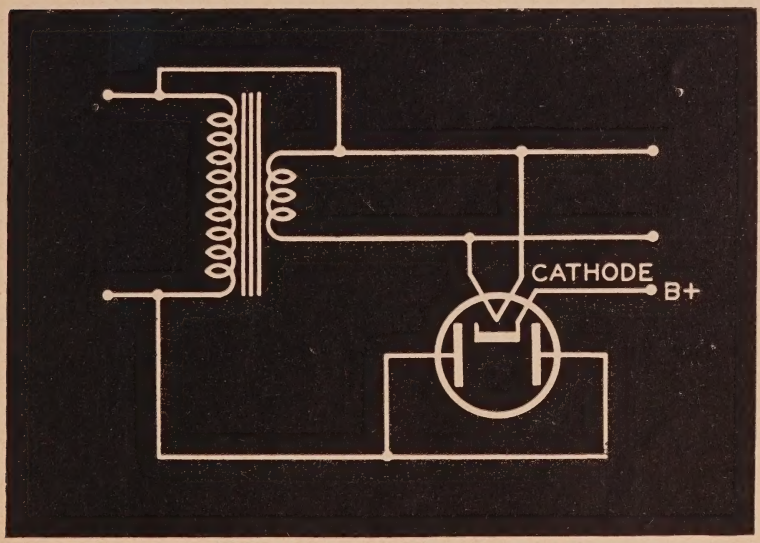


Figs. 3a (above) and 3b (below). How to increase B voltage by changing an electro-magnetic speaker to a p-m speaker. In a, we have the e-m installation, while in b, we have the p-m substitution.





Figs. 4a (above) and 4b (below). Here we have a method of using a transformer with an open transformer or a filament transformer as a power transformer with the B voltage coming directly from the line.



B. & S. Gauge	Diam. in Mils	Circular Mil Area	Turns per linear inch				Turns per square inch			Feet per pound	
			Enamel	S.C.C.	D.S.C. or S.C.C.	D.C.C.	S.C.C.	Enamel S.C.C.	D.C.C.	Bare	D.C.C.
10	101.9	10380	9.6	....	9.3	8.9	87.5	84.8	80.0	31.82	30.9
11	90.74	8234	10.7	....	10.3	9.8	110	105	97.5	40.12	38.8
12	80.81	6530	12.0	....	11.5	10.9	136	131	121	50.59	48.9
13	71.96	5178	13.5	....	12.8	12.0	170	162	150	63.80	61.5
14	64.08	4107	15.0	....	14.2	13.8	211	198	183	80.44	77.3
15	57.07	3257	16.8	....	15.8	14.7	262	250	223	101.4	97.3
16	50.82	2583	18.9	18.9	17.9	16.4	321	306	271	127.9	119
17	45.26	2048	21.2	21.2	19.9	18.1	397	372	329	161.3	150
18	40.30	1624	23.6	23.6	22.0	19.8	493	454	399	203.4	188
19	35.89	1288	26.4	26.4	24.4	21.8	592	553	479	256.5	237
20	31.96	1022	29.4	29.4	27.0	23.8	775	725	625	323.4	298
21	28.46	810.1	33.1	32.7	29.8	26.0	940	895	754	407.8	370
22	25.35	642.4	37.0	36.5	34.1	30.0	1150	1070	910	514.2	461
23	22.57	509.5	41.3	40.6	37.6	31.6	1400	1300	1080	648.4	584
24	20.10	404.0	46.3	35.3	41.5	35.6	1700	1570	1260	817.7	745
25	17.90	320.4	51.7	50.4	45.6	38.6	2060	1910	1510	1031	903
26	15.94	254.1	58.0	55.6	50.2	41.8	2500	2300	1750	1300	1118
27	14.20	201.5	64.9	61.5	55.0	45.0	3030	2780	2020	1639	1422
28	12.64	159.8	72.7	68.6	60.2	48.5	3670	3350	2310	2067	1759
29	11.26	126.7	81.6	74.8	65.4	51.8	4300	3900	2700	2607	2207
30	10.03	100.5	90.5	83.3	71.5	55.5	5040	4660	3020	3287	2534
31	8.928	79.70	101	92.0	77.5	59.2	5920	5280	....	4145	2768
32	7.950	63.21	113	101	83.6	62.6	7060	6250	....	5227	3137
33	7.080	50.13	127	110	90.3	66.3	8120	7360	....	6591	4697
34	6.305	39.75	143	120	97.0	70.0	9600	8310	....	8310	6168
35	5.615	31.52	158	132	104	73.5	10900	8700	....	10480	6737
36	5.000	25.00	175	143	111	77.0	12200	10700	....	13210	7877
37	4.453	19.83	198	154	118	80.3	....	....	....	16660	9309
38	3,965	15.72	224	166	126	83.6	....	....	....	21010	10666
39	3,531	12.47	248	181	133	86.6	....	....	....	26500	11907
40	3.145	9.88	282	194	140	89.7	....	....	....	33410	14222

Fig. 6. Copper wire coil data chart. These data are useful when rewinding primaries of transformers.

Using Low-Voltage Transformers

Filament transformers, or any transformer with low-voltage windings, are very handy for line-voltage modification either up or down, as shown in Fig. 7. The transformer really becomes an autotransformer with this connection, with an output rating equal to the current rating of the filament winding. Transformer rewinding is necessary in some instances. Most power transformers have from 4 turns-per-volt for large units to 10 turns-per-volt for the smallest units. The primary is usually wound nearest to the core, although this is not always the case. If, however, the primary is next to the core, the filament and high-voltage winding may be easily removed, cutting the latter with a razor blade and removing one layer at a time, allowing the primary winding to remain. It is then a simple matter to add filament or other low-voltage windings when desired.

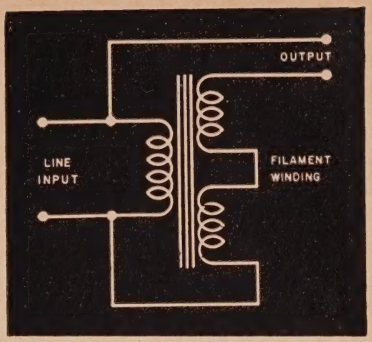


Fig. 7. Using a filament transformer as an auto-transformer for raising or lowering line voltage.

TONE CONTROL CIRCUITS

(Continued from page 4)

to be attenuated, or the highs to be attenuated. When R_1 is turned all the way to the right, C_2 is shorted out and the low frequency response is determined by the size of C_1. As R_1 is rotated to the left, C_2 is introduced in series with C_1 which causes a decrease in low frequency response. As R_1 is

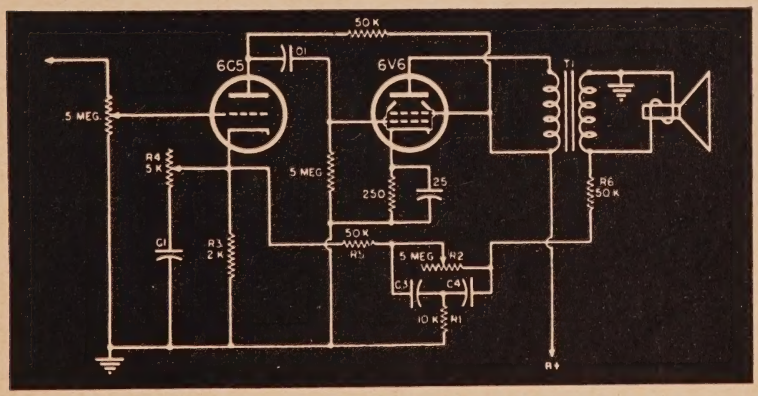


Fig. 5. Typical preamplifier and output stage of a small receiver, incorporating independent high- and low-frequency controls for obtaining desired tonal response.

rotated even farther to the left, C_3 is shunted across the grid of V_2 attenuating the high frequencies. This gives the two functions all on one control. If, in addition, a high frequency and low frequency boost be incorporated in some other part of the circuit, it will permit any tone quality desired.

In Fig. 5 we have the typical preamplifier and output stage in a small receiver or automobile radio to which have been added two of our circuits. We find incorporated independent high frequency and low frequency boost controls. This is particularly advantageous when a small receiver is to be connected to a well baffled 10″ or 12″ speaker. It is amazing what can be done with the average six or seven tube table model radio in this respect. It is quite possible to enhance its tone quality to the point that it compares favorably with those in the $200.00 class. The older automobile radios may be given the same treatment with great improvement in tone quality. The tone control system in Fig. 5 is of a negative feedback type. A voltage is fed back from the secondary of the output transformer through the high pass filter C_3, R_1, C_4, R_2 to the cathode of the previous amplifier stage. This then reduces the tube gain at the high frequencies. The cathode resistor R_3 is bypassed with the network R_4, C_1 which varies the degeneration in the circuit at the high frequencies. R_2 is a variable resistor shunted across the high pass filter in the feedback network so that C_3, C_4 may be shorted out and the circuit then becomes non-frequency discriminatory. This, then, effectively controls the low frequency boost while R_4 controls the high frequency boost. C_1 may be from .01-.25 μfd. and C_3-C_4, may be .01 to .1 μfd. R_5 and R_6 are made as small as possible without oscillation occurring. If a violent oscillation occurs, reverse the connections to the output winding of the output transformer T_1.

In Fig. 1 is another type of tone control. It falls in the automatic class. It consists of compensation in the volume control circuit so arranged by means of a tap on volume control R_2, that as R_2 is turned away from ground, the amount of compensation is decreased. R_1, C_1 tend to give a bass boost while C_2 increases the high frequency boost as the volume is decreased. This circuit is in common usage in commercial radios.

Fig. 4 presents a different approach to the problem. Here we effectively build an amplifier stage for low frequencies, and an amplifier stage for high frequencies, and we mix their outputs, and we connect their inputs to a common source. We merely vary the gain of each circuit to vary the amount of high or low frequency response. In Fig. 4, R_x would control the high frequency response, while R_y controls the low frequency boost or attenuation. This circuit has many variations such as resonant LC networks in the plate circuits of the first 6SL7. Then we come to the LC types of tone control circuits. The difficulty in obtaining iron core inductances at this time decreases their desirability and makes the RC type easier to procure the parts for.

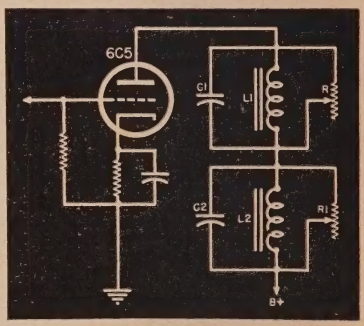


Fig. 6. Tone-control circuit, employing inductors and capacitors.

The circuit in Fig. 6 can be used, however, and old audio transformers or a.c.-d.c. chokes substituted for the proper chokes. The Thordarson Company make several inductors for this

purpose which resonate at 40 and 5,000 c.p.s., respectively, with the two recommended values of condenser C_1, C_2. R and R_1 vary the amount of boost at each frequency. Three or more inductors could be used so that several frequencies could be boosted at will to compensate for the combined deficiencies of a poor pickup and a small speaker.

All in all, however, these RC tone control circuits may be applied to nearly any audio circuit, and will give very satisfactory control of high and low frequency response.

THE RADIO TRADING POST

(Continued from page 6)

WANTED—Radio Mechanic. Good salary in good town. Write particulars to Eldridge Electric, Box 163, Lenora, Kansas.

WANTED—16mm projector, also contact mike for musical instruments. Have cash, tubes, radio equipment, what do you want. John Arnold, P.O. Box 84, Bluffs, Illinois.

WANTED—To buy, cash, Superior model 1230 signal generator or any make. Also Triplett 1220 point to point tester and a condenser analyzer. All letters answered. Robt. M. Bowman, 359 Berry St., Jackson, Tenn.

FOR SALE—Experimental short-wave receiver, 5 bands, 10 tubes, complete with tubes and speaker, $28. V. Kozma, 3104 Wilkinson Ave., New York 61, N. Y.

FOR SALE—Popular music sheets, about 500, late numbers, orchestration for band, the whole lot at $7.50. Joseph M. Kozma, Jr., 3104 Wilkinson Ave., Bronx, New York.

FOR SALE—Webster phono-record changer brand new. Very reasonably priced. Also rim-driven phono motor with 9" turntable. Charles Kotval, 2430 So. 58th Ct., Cicero, Illinois.

WANTED—For cash, phono pickup and turntable, VOM and recording playback, radio unit. State condition, make, price. FOB Denver, Colo. All letters answered. H. W. Patton, A.S. V-12 USNR, 201 McKenna Hall, University of Colorado, Boulder, Colorado.

FOR SALE—Alliance phono motor, 110 v. ac, never used, with turntable, $7.00. New Cornell-Dubilier capacitor analyzer, model BN, with tubes, leads and instructions. Louis Fialkoff, 143-48 41 Ave., Flushing, L. I., N. Y.

WANTED—Tube tester in good condition. State make, model number and price. Must be ac operated and able to test all type tubes present and past. Frank Teicher, 717 E. 175 St., New York 57, N. Y.

FOR SALE—Meissner de luxe signal shifter, R.M.E.-9 5 band crystal controlled receiver. RCP No. 665 tester. Good 35 mm camera, Zeiss 2.8, 1/300 shutter. Want condenser blocks for RCA RE-18 receiver. D. Hepburn, 1922 Palmer Av., Larchmont, New York.

FOR SALE—Brush RC-20 crystal cutting head $12.00. Astatic type S-12 pickup with General Industries dual speed turntable, $25.00. Frank Dane, 3852 Eagle Street, San Diego 3, California.

WANTED—Plug-in model record player to attach to radio, also table model radio. Give price, etc. Leon Schwartzman, 1785 Bryant Ave., Bronx 60, New York.

SELL—At list, 6K8, 6SA7, 7C7, 7B7, 12A6, 12J5, 12SK7, 12SQ7, many others. Send payment with order and will ship postpaid. Newton Center Radio, 759 Beacon St., Newton Center 59, Massachusetts.

FOR SALE—Westinghouse deviation meter, type HV, Meissner FM tuner, mod. 9-1047-A, $30.00. Jon W. Smith,, 113 S. Stricker St., Baltimore 23, Md.

WANTED—Triplett mod. 1220-C free-point tester complete with adapters and instructions, all cables must be in working condition. Smith Radio Service, 132 So. 7th St., Steubenville, Ohio.

WANTED — One each 25B8GT, 32L7GT, 70L7GT, 25Z5G; magnet wire No. 30 dsc. Want set 6 prong plug-in coils 140 mmfd. Readrite panel meters, volts, ma., ohms. Andy R. Harcar, Jr., Birdsboro, R.D. 2, Penna.

WANTED—Echophone EC-1, new or used. Will pay top prices, also table model radios. Reed B. Gillette, RFD 1, Sharon, Conn.

FOR SALE OR TRADE—Clough Brengle, mod. OC signal generator (6 bands; fundamentals) $35.00. Portable. Or will add cash in trade for reflex or 35mm camera. Gursh, 1481 Shakespeare, New York 52, N. Y.

FOR SALE—Majestic, Kolster, Philco, Colonial, and Fada radios, chassis and spkrs. Write for particulars. Louis A. Goldstone, 1279 Sheridan Ave., Bronx 56, New York.

WANTED — A Crosley 117 power supply unit, new or used. Harold K. Tryon, Pittsford, Vermont.

WILL SWAP—Plug-in record player, filter, extral pickup. Need tube tester or signal generator or volt ohm meter. Make offer. Leon H. Frantz, 305 Polhemus, San Jose, California.

WANT—Hammarlund Pro., Scott or similar all-wave receiver, age or condition not important. Also Weston 772 or similar. Riders Manuals,, courses, dynamic tube tester. Send list. Glenn Watt, Chanute, Kans.

WANTED—SW receiver as Hallicrafters SX9, SX24, S20, or Howard 438, Echophone I, II, III. Will trade against other radios, meters, tubes, and part cash. Sets must be in perfect condition. G. Samkofsky, 527 Bedford Ave., Brooklyn, N. Y.

FOR SALE—Supreme deluxe analyzer 333, $25; Thordardson transformers, choke, 250 power pack, assembled using T-2950 power transformer, $20, with speaker field supply. Clair E. Breth, Sr., 213 South 4th St., Youngwood, Pa.

FOR SALE—Superior channel analyzer, in good shape, one ac volt output meter 1 to 150 v.a.c. Wood Radio Shop, Morrison, Tenn.

WANTED—Complete set of Riders Manuals, Supreme Manuals 1 to 5, signal generator, late model tube tester and Multitester, small cabinets for radio parts, toaster and iron elements. Fred's Radio Service, Box 706, Stryker, Ohio.

WANTED—Test equipment. Write stating what you have, price and condition. Stanley T. Galaski, 223—54th Street, Brooklyn 20, New York.

WANTED—Late model combination tube and set tester. State model and price. Seymour Hammer, 2090 Morris Avenue, Bronx 53, New York.

WANTED—Phono motors and turntables, any type, new or used, any quantity, for cash. Also want amplifiers, arm and crystal pickups, record players, and radio combinations. J. R. Travis, 3831 East 21 Place, Tulsa 4, Oklahoma.

WILL TRADE—50L6's for following: general coverage and band spread coils and instructions for National SW-3, model No. 2.5v, ac;2 12B8, 2 25B8, 3 70L7, 2 47, 3 1A7. Kalashian's Radio Repairs, 2A Congress St., Newburyport, Mass.

BARGAIN—Set of Instructograph tapes in American Morse, never used, 75c apiece. Jay Haley, Mayeton Hotel, Superior, Wis.

FOR SALE—Westinghouse Motor-generator, ac motor, ¼ hp, 110 v, 3.5 amps., 3450 rpm, dc generator, 350-500 v, .2 amps, .1 kw. Like new, A1 condition, $75.00 cash. Geo. D. Bowers, 604 Scarborough Ave., Rehoboth Beach, Del.

FOR SALE—3000 new tubes at 30% off OPA list. Send for list. Humphreys Music Company, 130 Pine Ave., Long Beach 2, California.

TUBES FOR SALE—I have all types in stock including 1.5 v, 12v, 25, 35, 50, etc. v. tubes. Specify type and quantity desired, include sufficient money to cover postage and handling as well as list price of tube. General Radio Service, 166 North Sierra Bonita, Pasadena 4, California.

FOR SALE—44 type 1A5 GT/G tubes, new in cartons, National Union, 50% off list, or make offer; Universal single button mike and nickeled desk stand with all rubber base and mike springs; Stromberg No. 3-A 2,000 ohm head set. Need phono motors. Wm. M. Fury, 5939 Colgate St., Philadelphia 20, Pennsylvania.

FOR SALE OR TRADE—3 RCA 150 watt transmitters, 30—50 watt tranmtrs. with 5 Weston meters, 2—200 watt, 10—10 watt transmitters. All govt. surplus. Send stamp if photo is desired. Want 1 861 tube or other high power transmitter tubes. Nelson K. Stover, 1357 Hill St., York, Penna.

FOR SALE—Little used Meissner combination FM-AM-SW receiver, 17 tube, mod. 9-1054. $90.00. Harry Spiegel, 8840 Commercial Ave., Chicago 17, Ill.

FOR SALE—Four Millen IF transfs. for FM, three 60503 interstage, one 60504 discriminator, $15 for lot. Meissner 10-1152 high-fidelity broadcast tuner, complete with tubes $30. William L. Smith, 10110 Pierce Drive, Silver Spring Maryland.

FOR SALE—Weston 776 oscillator, 669 VT VM; Dumont 158, 9" oscillograph and tube; Clough-Brengle ODA oscillator, new bats.; Hickok 47X capacitor meter; Carron CCH signal tracers. All perfect. Lewis M. Clark, 105 Second St., Campbellsville, Ky.

WANTED — 15" dynamic speakers, less transformers, 8 ohm voice coils, 5400 ohm field, Jensen or Utah preferred. Must be perfect, top price paid. Hart Radio, 102 Hurd Ave., Findlay, Ohio.

FOR SALE — Precision signal generator, model E-200. Perfect condition, best offer. James E. Bruns, 1226 Wisconsin Ave., N.W., Washington 7, D. C.

FOR SALE—Dunlap (Sears Roebuck) metal lathe, 6" swing, 18" between centers. 2 adjustable headstock bearings, bedways trued. Chuck, dogs, gears, pulleys, shaft hangers, FOB Passaic $75. Leo Friedman, 444 Gregory Ave., Passaic, N. J.

FOR SALE OR SWAP—All kinds of surplus transmitting tubes now available. Brand new and guaranteed perfect. Send for list. No priority needed. B. Jacobus, 559 Broadway, Newark, N. J.

FOR SALE—Radio parts manufactured by National Co., such as type B dials, trans., conds., etc. Parts unused 40% or more off net. Send for list. M. L. Brownstein, 4653 Boudinot Street, Philadelphia 20, Pa.

FOR SALE—Solar condenser quick check and bridge, model BQC 1-60, $15.00, also Lionel multivolt trans., type B, 6-25 volts in one volt steps, $2.50. Both in good condition. Aubrey Edgerton, 116 West 6th Ave., Houston 7, Texas.

FOR SALE—One brand new Mark's Mechanical Engineers' Handbook, 4th ed. Published by McGraw-Hill Book Co. Will sell for $5.00. L. W. Thomsen, 46 Ledge Lane, Stamford, Conn.

FOR SALE—Two Philco auto radios, A-1 shape, $25.00 each. One 1/4 hp, 110v. ac motor, $14.00. Solar CE condenser analyzer, new, $60.00. Arvin 8 tube auto radio, $25. Paul Capito, 637 W. 21 St., Erie, Pennsylvania.

FOR SALE—Instructograph code machine, a.c. electric type, ten tapes. Le 'Zak Radio Service, 155 South 1st St., Brooklyn 11, New York.

WANTED — Battery charger, signal gen., portable phonograph and ampl. comb., and tubes 1A7, 1H5, 1N5, 35Z5, etc. For sale—VOM, tubes, etc. Royce Saxton's Radio Shop, R. 1, Pontiac, Illinois.

FOR SALE—National N.C. 80X, 10 tube superhet communication receiver, covers 550 kc to 32 mc in 4 bands. Le 'Zak Radio Service, 155 South 1st St., Brooklyn 11, New York.

WANTED — Radio tubes (1 each) 35Z3, 35Z5, 35L6, 35Z6. L. W. Landt, 1907 E. 3rd St., Long Beach, Calif.

FOR SALE—Tubes at 40% off list prices. Send stamp for list. Crose Radio Service, 901 Touhy, Park Ridge, Ill.

WANT — Engineering manuals, state age and edition. Will trade photo equipment, 35 mm. motion picture camera and projector or cash. Wm. Hansen, 165 Silverbrook, Niles, Mich.

FOR SALE—Large quantity of tubes, all new at OPA list price. Send list of your needs. L. Stein, 456 Bedford Ave., Mt. Vernon, New York.

WANTED—Rider's Manuals 4, 11, 13 and 14 and all kinds of test equipment. Capitol Radio Service, 107 Virginia Ave., Cumberland, Md.

WANTED—VOM, tube tester, and signal generator or combination multimeter and tube tester. Prefer signal generator battery or ac/dc operated. Frederick M. Keller, 26 Trull St., Somerville 45, Mass.

FOR SALE—Readrite Big Boy VOM, Mod. 860, has 7" Triplett meter. Ranges to 15 meg., 1000 v. ac-dc, 100 ma. Also DB and output ranges. New in original carton $22.50. Also have a Majestic camera type portable radio, model 130A complete with tubes and batteries, new. $22.50. Less than 5 lbs. Gerald Samkofsky, 527 Bedford Ave., Brooklyn, N Y.

SELL OR SWAP—Converter 32v dc to 120 v ac, 100 watts, 2 WE211E tubes, WE output trans. 128A-211E tubes to 250 or 500 ohm line. WE 282B and 284A tubes. 5 WE 555W speakers, Carron Diaphragms. H. H. Harrison, 300 37th St., Sacramento, Calif.

FOR SALE—Phono motor, used in Philco sets. Brand new. Would like 25Z6, 25-A6 tubes. Frank McCauley, Jr., 69 Roxen Road, Rockville Centre, N. Y.

AIR CIRCULATING FIREPLACE provides superior fuel utilization. Use scrap plate and weld your own or have it done locally. Complete plans, description and photographs of a 36" circulator, $2.00. Grapnel, R.F.D. No. 4, Putnam, Conn.

FOR SALE—Tubes, in original cartons, O PA list price, send for list. Wanted 4 12" PM with 7 lb. magnets in good condition. State price. Lew Wallaston Radio Line, 1111 Grand Ave., Alliance, Nebraska.

FOR SALE—1 each Solar type CA, condenser analyzer (bridge), Superior Dynarometer, ac-dc, VOM and VTVM, 9" meter, Supreme model 530, 2" oscilloscope with extra 2" cathode ray tube, Supreme model 551 ac-dc VOM and freepoint analyzer, Hickok frequency modulator type OA2. John Archibald, 1722 Mellville St., Bronx 60, N. Y.

FOR SALE—Two Majestic power speakers, Model G-1 and G-2, best offer takes them, also few hard to get tubes. D. H. Ammon, 50 Russ St., Hartford 6, Conn.

WANTED—Radio test equipment; manuals, parts, etc. Cash or trade. What do you need. Can furnish printing. Shafer Radio Service, 246 N. Valley, Kansas City 2, Kansas.

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